

## THE SONG OF THE SONG SPARROW

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THE songs of oscine birds vary greatly. No two individual birds sing in exactly the same way, and the songs of any given individual bird vary (Saunders, 1924). These two sorts of variation are more obvious in the Song Sparrow, *Melospiza melodia*, than in any other bird I have had opportunity to study.

To date my collection of records of Song Sparrow songs numbers 884, no two of which are exactly alike. The songs were recorded by my 'graphic method' (Saunders, 1915, 1929, 1938). The records are mainly from Connecticut and New York. A few from the vicinity of Columbus, Ohio, include those of certain individuals studied at Interpont by Mrs. Nice (1937, 1943).

*Length of song.* The 884 recorded songs varied in duration from 1.8 to 5.2 seconds, the average being 2.7 seconds. The shortest and longest songs were exceptional, the latter being a flight-song (Fig. 1). If we disregard one short song of 1.8 seconds duration and three unusually long songs (respectively of 4, 5, and 5.2 seconds) the remaining 880 songs varied from 2.2 to 3.2 seconds in length, and 81% of these were from 2.6 to 3 seconds in length. Of the 884 songs, 265 were 2.8 seconds long.

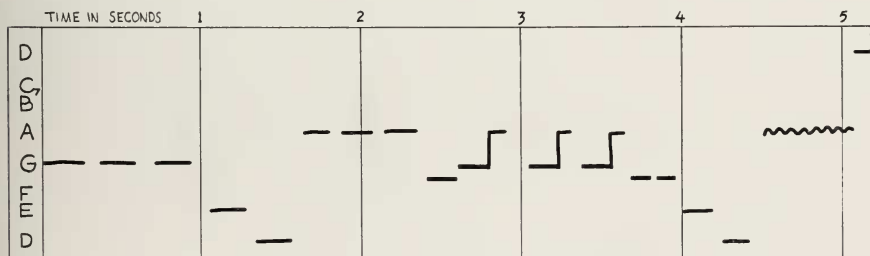


FIG. 1. Graphic record of an exceptionally long Song Sparrow song. This song was a flight-song. Fairfield, Connecticut, March 21, 1925.

Song Sparrow songs are usually rhythmic. The accented, obviously *beat-out* introductory notes are followed by notes each equal in time to one of the introductory notes, or exactly twice as fast, and trills are frequently just two or three times the length of one introductory note. A few rhythms are exceptional, as, for example, that produced in two exactly equal periods of time, one by five notes, the other by seven. Occasionally a song seems to have no rhythm at all except in the introductory part.

*Pitch.* In former papers on bird songs I have used such symbols as  $C'''$  and  $C''''$  to indicate the different octaves. Brand (1935) used a better method, namely, C for the lowest C on the piano; and  $C_1$ ,  $C_2$ , etc., for notes respectively one, two and more octaves higher,  $C_7$  being the highest. In my method C meant middle C on the piano,  $C''''$  the highest C. In this paper I am using Brand's method.

Brand (1935: 49-50) studied three Song Sparrow song-records made by sound photography on film, finding therein numerous short notes which were inaudible to the human ear and exceedingly high in pitch. From his later study of four recordings (1938: 267) he concluded that the vibration-frequencies of Song Sparrow songs varied from 1900 to 7700 per second. This is practically a two-octave range, from about  $A_5$  to  $A_7$ . The four recordings under discussion were evidently made from three individual birds. My own records have been limited to notes that the human ear could hear, of course. The 884 records—of about 685 individual birds—display a range in pitch from  $D_5$  to  $F_7$  (1150 to 5450 vibrations), though the great majority of them range only from  $A_5$  to  $D_7$  (1900 to 4600 vibrations). I did not record pitches as high as those found by Brand, probably because the highest-pitched notes were so very short that I did not hear them. I have heard and recorded songs (of other bird species) ranging higher than 7700 vibrations, but these high notes were sustained. From my experience I conclude that it is exceedingly rare for a Song Sparrow to sing a note pitched higher than  $D_7$ —that is, long enough for the human ear to hear it.

In recording bird songs in the field, taking down the relative pitches of the notes and the pitch-intervals between one note and another is a simple matter; but taking the exact pitch, as heard by ear, is another step that I did not always have time to complete. In only 445 records did I ascertain the exact pitch. In none of the remaining 439 songs was the pitch unusually high or unusually low: had it been so, I would certainly have recorded the exact pitch.

Song Sparrows usually are quite accurate in pitch; that is, they use definite tones and half-tones in their singing. Occasionally one encounters a bird whose singing includes an off-pitch note or two. See, in this connection, the fourth note of record No. 14 (Fig. 2). Here the bird used approximately a quarter-tone.

An average Song Sparrow song ranges through a little more than  $3\frac{1}{2}$  tones. The greatest range I have recorded for a single song is  $7\frac{1}{2}$  tones, the least for a whole song, 1 tone. According to my records far more Song Sparrows have, oddly enough, a range of  $2\frac{1}{2}$ ,  $3\frac{1}{2}$ , 4, or  $4\frac{1}{2}$  tones than have a range of 2 or 3 tones. Of the 884 songs I recorded, 1 (only) had a range of but 1 tone; 5 had a range of  $1\frac{1}{2}$  tones; 35 had a range of 2 tones; 149 had a range of  $2\frac{1}{2}$  tones; 38 had a range of 3 tones; 304 had a range of  $3\frac{1}{2}$  tones; 106 had a range of 4 tones; 132 had a range of  $4\frac{1}{2}$  tones; 64 had a range of 5 tones; 15 had a range of  $5\frac{1}{2}$  tones; 32 had a range of 6 tones; and 1 each had a range of  $6\frac{1}{2}$ , 7, and  $7\frac{1}{2}$  tones.

To a musician the significance of the above-mentioned figures will be apparent. For those whose knowledge of music is not so great, the following explanation may be welcome. All of the simpler, better known melodies in human music, if played on the piano in the key of C, will fall almost entirely on the white notes; or if played in any key, they will fall mainly on the notes of the diatonic scale, *do, re, mi*, etc. Now the interval of two tones, if spaced from each white note in an octave on the piano, will fall on another white note 3 times out of 7, or 43% of the time. The interval of  $2\frac{1}{2}$  tones will fall on another white note 6 times out of 7, or 86% of the time. Similarly the other intervals: of 3 tones, 29%;  $3\frac{1}{2}$  tones, 86%; 4 tones, 43%;  $4\frac{1}{2}$  tones, 47%; 5 tones, 71%;  $5\frac{1}{2}$  tones, 29%; and 6 tones, 100%. Compare these figures with the number of Song Sparrow songs having these intervals in the paragraph above. If we allow for the fact that the average song has a range of  $3\frac{1}{2}$  tones, and that songs with greater range must be fewer in number, the figures reveal that the Song Sparrow's standard of pitch is similar to that of man; that those intervals which are harder for man to sing are less often used by the Song Sparrow; that the bird uses such intervals as fourths, fifths, and octaves—intervals that are natural, because based on mathematical relationships between the numbers of vibrations: in short that the Song Sparrow sings mainly on the notes of the human diatonic scale.

This is true of most song birds, a fact which has been discussed before by others, notably Clark (1879). It indicates that, in such birds, something more than defending a territory or advertising for a mate must have had a part in song evolution (Saunders, 1929: 125-130). It is because of this that, now and then, we meet with a bird that sings something like a bit of human music. The pitch is higher, the quality is different, but the time and pitch-intervals are the same. For example, the first six notes of song No. 18 (Fig. 2) are identical in pitch-interval and time with certain notes of a song that was popular many years ago. The words that fit the notes are "... Reuben, I've been thinking."

*Intensity.* The intensity of Song Sparrow song does not vary greatly. Certain songs contain one or more high-pitched, strongly accented notes like the terminal notes of Nos. 10 and 13 (Fig. 2). Other songs contain one or two introductory or terminal notes that are of low intensity and audible only for a short distance. I have made no attempt to measure the intensity of Song Sparrow song. The distance a bird note (or any sound, for that matter) carries is not, necessarily, a measure of its intensity. Variation in intensity can be measured when the notes are of the same quality and pitch, as they are in many songs of the Field Sparrow (*Spizella pusilla*), a species whose song-intensity I have reported on (Saunders, 1922). The high-pitched, though seemingly faint notes of many birds carry farther than low-pitched notes which are obviously louder. Pitch and quality, as well as intensity or volume, determine the distance a sound carries. Overtones may cut down the distance, and since overtones are often

low, sounds of low pitch and unclear quality do not carry well. Balloonists tell us that the last sounds they hear from the earth below them as they rise are the high-pitched cries of little children.

*Quality.* Song Sparrow songs are extremely variable in quality. Average songs are sweetly whistled, but some songs are, as a whole, squeaky, husky, buzz-like or rattle-like, and occasional notes in otherwise 'sweet' songs may be of this sort. To me the quality of the Song Sparrow's song is more variable than that of any other common North American species of the family Fringillidae.

*Consonant Sounds.* Consonant sounds are not very noticeable in the Song Sparrow's song. Those that occur are explosives, suggesting the letter *t*, or sibilants such as the letter *s*. Individual songs vary greatly in this respect (Nice, 1943: 116).

#### THE SONG AND ITS COMPONENT PARTS

The Song Sparrow song has been described as "short introductory notes, a central trill, and a flourish of notes and slurs at the end" (Wheeler and Nichols, 1924: 445). I would change this description by substituting "two-note phrases" for "slurs." True slurs, in my experience, are rare in Song Sparrow songs, whereas two-note phrases are exceedingly common. Songs Nos. 4 and 17 (Fig. 2) are normal songs containing a *slurred* note each. By a "two-note phrase" I mean a phrase composed of two notes closely connected but of abruptly different pitch. The last two notes of song No. 12 (Fig. 2) is an example. In a *slur* the change of pitch is gradual. A two-note phrase, for example, might sound like "teeto," whereas a corresponding slur would sound like "teeyo."

*Introductory notes.* These vary in number from 1 to 7 (average: 2.7). They are all short and staccato, of the same pitch, equal in time, and separated by short pauses. They may be sung slowly, at a rate of 3 per 1.2 seconds, or rapidly, at a rate of 3 per .4 of a second. The slower time is commoner.

While these introductory notes are usually as I have described them, I have on occasion heard a song in which each introductory note is actually a two-note phrase with one note shorter than the other. The short extra note may either precede or follow the main note, and it may be of either lower or higher pitch. Each of these four conditions is illustrated, respectively, in songs Nos. 7, 8, 15 and 17 (Fig. 2). I have 77 records of songs with introductory notes of this sort. In 48 of these the extra note followed the main note (25 at higher pitch, 23 at lower pitch). In 29 the short note preceded (26 at lower pitch, 3 at higher pitch).

*Central Trill.* Most Song Sparrow songs contain, somewhere in the central portion, sometimes at the end, either a trilled note or a series of rapidly repeated notes all on the same pitch. Trills and rapidly repeated notes are essentially the same phenomenon, the difference being merely that in the trill the notes are too rapid for the ear to count. In my records all these rapidly re-

peated notes are called trills. Of the 884 songs, 55 had no trill, 580 had one trill, 259 had two trills, 9 had three trills, and 1 had four trills. The average had 1.3 trills. Trills are normally sustained on one pitch, but in one song (Fig. 2, No. 11) the trill gradually dropped a full tone.

*Remainder of the Song.* The terminal flourish of notes and two-note phrases is extremely variable. A given bird may sing the same song over and over, all parts being the same each time except for the last few notes. These final notes may be varied by additions, omissions, or changes in pitch. In recording such songs in the field I encircle notes that are variable or sometimes omitted. Often I am obliged to make records of the two or three different endings in this way. Especially is this true of my recording of Song Sparrow songs. The last note of No. 9 (Fig. 2) is an 'encircled note.'

#### TYPES OF SONGS

When one has a large number of records of the songs of one species it is necessary to file them so that similar songs can be kept together for comparison. I have divided my Song Sparrow songs into types based on the way they begin. In some cases I have found it useful to subdivide further. Wheeler and Nichols (1924) divided songs into two groups. When I tried classifying my records in this way, altogether too many normal songs belonged to neither group; but when I divided them into five groups all but eight could be placed, and three of these eight were primitive or juvenile songs.

The type to which a given song belongs is determined by the relation in pitch of the introductory notes to the trill and by the position of the trill (or in the case of more than one trill, by that of the first trill). A key to these types is as follows:

Introductory notes followed immediately by trill.

Introductory notes and trill on the same pitch. Type 1 (Nos. 1-3, Fig. 2).

This is Group B of Wheeler and Nichols).

Trill higher in pitch than introductory notes. Type 2 (Nos. 4-8, Fig. 2).

This is Group A of Wheeler and Nichols).

Trill lower in pitch than introductory notes. Type 3 (Nos. 9-11, Fig. 2).

Introductory notes separated from trill by one or more notes.

Introductory notes and trill separated by single note which is on a different pitch from either. Type 4 (Nos. 12-14, Fig. 2).

Introductory notes and trill separated by two or more notes, the first on different pitch from that of the introductory notes. Type 5 (Nos. 15-18, Fig. 2).

Of the 884 recorded songs, 159 (18%) were of Type 1, 191 (21.6%) of Type 2, 144 (16.4%) of Type 3, 137 (15.4%) of Type 4, 245 (27.7%) of Type 5, and 8 (0.9%) irregular.

In certain respects Type 1 is quite different from the others. In Type 1 two introductory notes (rather than three) are the rule. In Type 1 the trill is usually

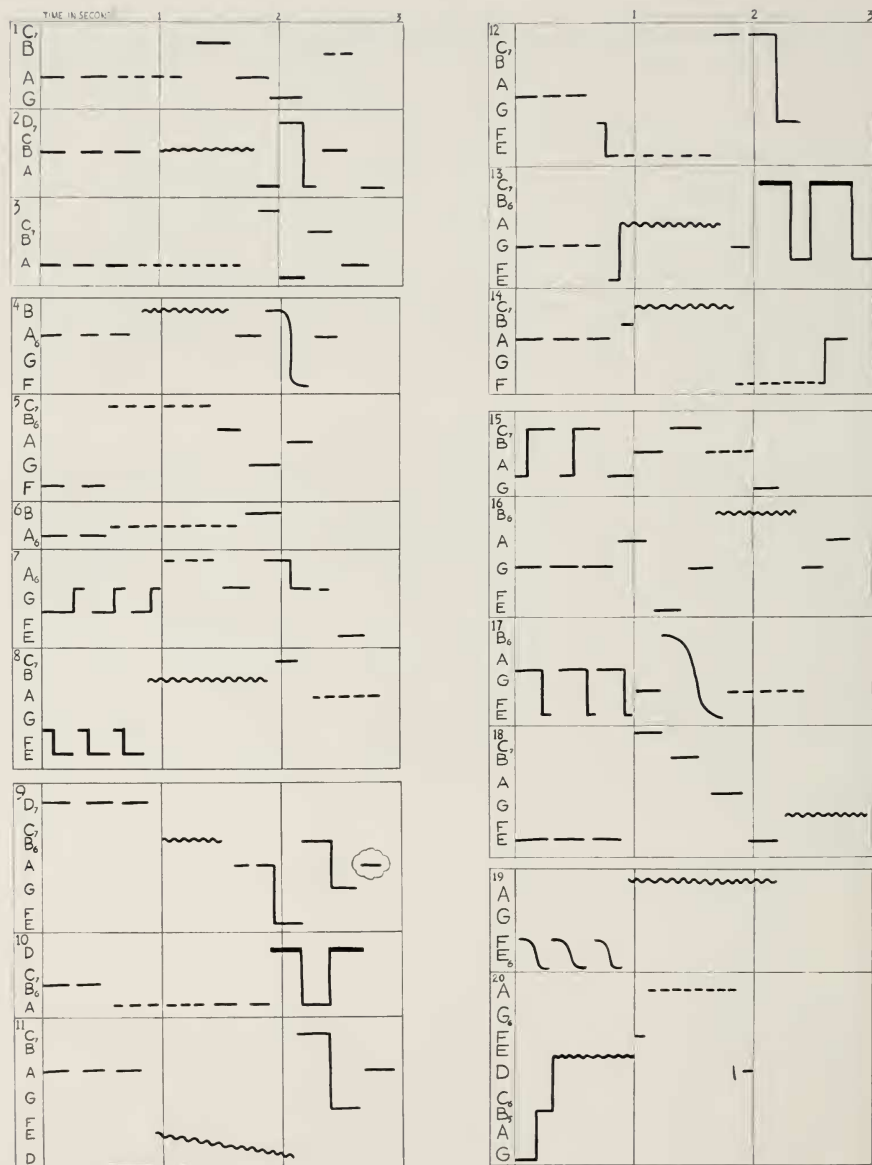


FIG. 2. Graphic records of Song Sparrow songs. 1. March 25, 1922. 2. June 9, 1921. 3. March 4, 1922. 4. July 16, 1921. 5. April 10, 1921. 6. April 11, 1923. 7. July 19, 1923. 8. June 27, 1921. 9. June 14, 1921. 10. March 25, 1922. 11. April 15, 1914. 12. October 24, 1922. 13. May 29, 1921. 14. February 25, 1922. 15. July 2, 1922. 16. August 10, 1921. 17. July 6, 1921. 18. July 22, 1922. 19. July 5, 1920. 20. March 22, 1943. All recorded at Fairfield, Connecticut except 4 and 17 (Quaker Bridge, New York); 7 (Savannah, New York); 11 (West Haven, Connecticut); 12 (Bridgeport, Connecticut); 13 (Norwalk, Connecticut); and 15 and 18 (Syracuse, New York). For a discussion of the types of songs these represent see p. 103).

not a true one (as it is in other types), but a series of rapid notes. An average Type 1 song opens with two notes which are followed by a series of rapid notes, and in a good many cases these rapid notes are just twice as fast as the introductory ones.

Type 4 songs may be further divided into 8 subtypes on the basis of the relative pitches of the introductory notes (which are all on one pitch), the single note between them and the trill, and the trill itself (which is almost invariably on the same pitch throughout). If we call the highest pitch 1, the medium pitch 2, and the lowest pitch 3, there are these six possible arrangements: 1-2-3, 1-3-2, 2-1-3, 2-3-1, 3-1-2, and 3-2-1. There are also two other arrangements in which there are only two pitches, 1-2-1 and 2-1-2, but there seem to be very few songs of these sorts. Of the 137 Type 4 songs, 9 had the 1-2-3 pitch-arrangement of introductory notes, single note, and trill; 35 the 1-3-2 arrangement, 19 the 2-1-3, 39 the 2-3-1, 16 the 3-1-2, 17 the 3-2-1, one the 1-2-1, and one the 2-1-2. Nos. 12-14 are examples of subtypes 4a, 4d, and 4f respectively. In 25 of my records of Type 4 songs, the note between the introductory notes and the trill is very short and connected with the trill, as in No. 13.

Type 5 songs are also divisible into 8 subtypes on the basis of the relative pitch of the introductory notes and the *two* notes immediately following them. Of the 245 songs of Type 5, 22 had a 1-2-3 (high-medium-low pitch) arrangement, 65 a 1-3-2 arrangement, 49 a 2-1-3, 37 a 2-3-1, 17 a 3-1-2, 32 a 3-2-1, 12 a 1-2-1 and 11 a 2-1-2. Note that the last two arrangements (two pitches only) again are less frequently used than the others. Songs 15-18 are examples of subtypes 5b, 5c, 5d, and 5e respectively. In 45 of my Type 5 songs three introductory notes are followed by three other notes in the same time but on different pitches (see Fig. 2, Nos. 16 and 18). Such songs are especially pleasing musically. Two songs of this sort I have diagrammed in a previous paper (Saunders, 1924: 249, Nos. 1 and 2).

Of eight 'irregular' songs that cannot be put into types, three were primitive or juvenile songs (Fig. 3); one began with a trill; three had two sets of introductory notes on different pitches; and one began with four very short notes each on a different pitch. In this last song the introduction was followed by *three* trills. The whole song was of such an unusual quality that I did not definitely know it was a Song Sparrow's until I saw the singer. In my notes I described the song as a husky squeaking suggestive of the twittering of a Cliff Swallow (*Petrochelidon pyrrhonota*).

*Local Variation.* Occasionally one finds a peculiarity in Song Sparrow song that is common to several individuals in a restricted locality. I have previously stated that slurs are rare in Song Sparrow songs. I have 22 records of normal songs that contain downward slurred notes. Three are from Connecticut, three from scattered localities in central New York, and 16 from Quaker Bridge, Cattaraugus County, New York. Nos. 4 and 17 are examples. The birds that

sang slurs of this sort all lived along the Allegheny River within half a mile of the Quaker Bridge railroad station. I have recorded many Song Sparrow songs from regions nearby, particularly in Allegany State Park, but noted no slurs in them. The occurrence of this "Quaker Bridge slur" is the best example I have of local variation in Song Sparrow song.

*Geographical Variation.* My Song Sparrow records represent three main geographical areas: (1) an eastern—Connecticut and southeastern New York, (2) a central—central New York, and (3) a western—southwestern New York. I have a few records from the Adirondacks and a few from Columbus, Ohio, but these samples are so small that it would be unwise to draw any conclusions from them. All five types of songs are sung by the Song Sparrows of the three above-mentioned areas. Of 514 eastern area songs 77 (15%) were of Type 1, 98 (19%) of Type 2, 103 (20%) of Type 3, 67 (13%) of Type 4, and 169 (33%) of Type 5. Of 167 central area songs 20 (12%) were of Type 1, 50 (30%) of Type 2, 24 (15%) of Type 3, 33 (19%) of Type 4, and 40 (24%) of Type 5. Of 186 western area songs 35 (19%) were of Type 1, 54 (29%) of Type 2, 21 (12%) of Type 3, 20 (10%) of Type 4, and 56 (30%) of Type 5. Nothing about these figures reveals any marked correlation between type of song and geographical area.

There is some evidence of geographical variation in the introductory notes of New York and Connecticut songs. In certain songs the main introductory notes are accompanied by shorter notes on a different pitch. Soon after I began recording Song Sparrow songs in the western area (Cattaraugus County, New York), I noticed that this type of introductory note was more common there than it had been in the eastern area (Connecticut and far eastern New York). Of a total of 514 songs recorded in the eastern area only 12 (2.4%) had had double introductory notes; of 167 songs in the central area 33 (19.8%) had had double introductory notes; and of 186 songs in the western area 32 (17.2%) had double introductory notes. Songs of the central and western areas were, in other words, somewhat alike, and together they differed from songs of the eastern area. This is indeed interesting because Song Sparrows of the eastern area belong to the subspecies *melodia*; those of the western area are of the subspecies *euphonia*; and those of the central area (Onondaga, Cayuga and Wayne Counties, New York), though intermediate between these two races, are "more nearly related to those of western New York than to those of the eastern part of the state" (personal letter of December 11, 1950, from Kenneth C. Parkes to George M. Sutton). My song-data presented above are surprisingly corroboratory of this concept.

Each individual male Song Sparrow sings a number of different songs. The number per individual varies from six to 24 (Nice, 1943: 116-117). What I have previously written on this subject (1924, 1938) was included in Mrs. Nice's figures. Since then I have added further data and now have records of 13



TABLE 1  
174 DIFFERENT SONGS SUNG BY 13 SONG SPARROWS

BIRD NO.	SONG-TYPE					TOTAL NUMBER DIFFERENT SONGS
	1	2	3	4	5	
1	2	0	1	0	3	6
2	2	0	2	0	4	8
3	0	1	0	3	5	9
4	2	0	1	0	6	9
5	0	5	1	0	5	11
6	0	2	1	2	7	12
7	2	0	3	3	4	12
8	0	3	7	2	3	15
9	1	3	1	1	10	16
10	2	3	2	1	8	16
11	3	3	3	0	9	18
12	0	2	4	3	9	18
13	0	5	6	1	12	24
Totals .....	14	27	32	16	85	174

individuals. The number of songs per individual still ranges from six to 24. Table 1 shows the number of different songs (and song-types) 13 individual birds sang. Each individual bird sang at least three song-types, several sang four, and two sang all five. Only seven sang Type 1; eight sang Type 4; but every individual sang Type 5, and all but one sang Type 5 as often as, or oftener than, any other type.

I have recorded a flight-song (Fig. 1) which was distinctly longer than other songs. It did not, however, begin with "tit-tit-tit" notes (Nice, 1943: 118). I have heard Song Sparrow flight-songs which began in this way and it is interesting to observe that flight-songs with such a beginning are common to a number of other species, the Phoebe (*Sayornis phoebe*) and Yellow-throat (*Geothlypis trichas*), for example.

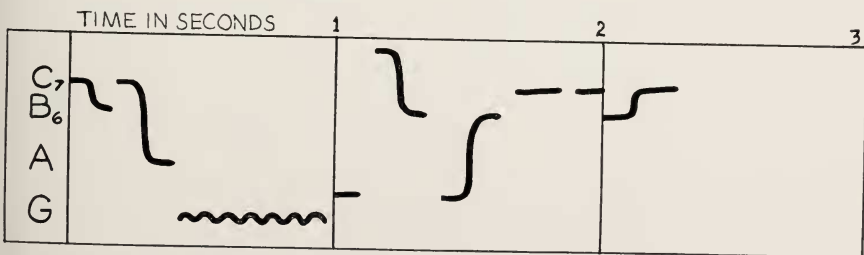


FIG. 3. Graphic record of a 'primitive' Song Sparrow song. Fairfield, Connecticut, September 20, 1924.

Figure 3 is a record of a primitive song. My three records of primitive songs are not much alike and there is nothing definite by which to distinguish them from primitive songs of other species. The notes are usually rapid but not loud.

*Imitation.* When one finds two Song Sparrows whose songs are nearly alike, the birds are apt to be singing within hearing of each other. In the spring migration, when the roadsides are full of singing Song Sparrows, one may often find two or three birds each beginning its song in the same manner and on the same pitch. But rarely do two such birds end their songs in the same way.

I presume that almost any oscine bird may, at times, do some imitating of the songs of other species. I have one record of a Song Sparrow song (No. 19, Fig. 2) which was much like that of a Field Sparrow, the introductory notes being downward slurs and the rest of the song a long, high-pitched trill. When I first heard this song I was doubtful about the species of bird that produced it. The quality was not quite so clear and sweet as that of a Field Sparrow, yet I did not expect it to be a Song Sparrow.

The last record of a Song Sparrow song (No. 20, Fig. 2) that I have recorded was rather astonishing, for the first 3 notes of the song were a perfect "*conquerer*" of the Red-wing (*Agelaius phoeniceus*). When I first heard this I thought two different birds were singing, first a Red-wing and then a Song Sparrow, but when I drew nearer it was clear that it all came from one bird, a Song Sparrow. So far as my ear could determine, the imitation was perfect. The pitch of the trill on E<sub>6</sub> was exactly right, for at least nine out of ten Red-wings sing it on that pitch.

#### SUMMARY

From a study of 884 records of the Song Sparrow's song the following facts are determined. Songs vary from 1.2 to 5.2 seconds in length, averaging 2.7 seconds. Pitch varies from D<sub>5</sub> to F<sub>7</sub> (1150 to 5450 vibrations) in notes that are audible to the human ear. Single songs range from 1 to 7½ tones in pitch, averaging 3½ tones. The bird commonly uses pitch-intervals similar to those used in human music. There is little variation in intensity, but some high-pitched notes are loud and strongly accented and carry well. Quality is usually sweet and musical, but quite variable. Consonant sounds are not very noticeable.

The song has three parts: strongly rhythmic introductory notes, a central trill, and a final series of rather irregular and indefinite notes. The introductory notes may vary from 1 to 7 but are usually 2 or 3. Trilling is part of a great majority of songs. Commonly there is one trill, frequently there are two trills, rarely there are three or four.

Songs are of five types. These types differ primarily in the position and relative pitches of the introductory notes and the trill. The percentages of these types vary somewhat geographically. Song Sparrows of the seacoast region of Connecticut and southeastern New York sing a song the introductory notes of

which are usually single; some individuals in central and western New York sing a song whose introductory notes are double.

An individual Song Sparrow sings from six to 24 different songs. It may sing from three to all five types of songs. Two individuals singing near each other sometimes sing songs which sound alike. Especially is this true of the introductory parts. Rarely does a singing Song Sparrow imitate any other species of bird.

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